

SPI Protocol Implementation for Space

The ECSS-E ST-50-14C defines analogue interfaces, bi-level discrete interface and serial digital interface (16-bit). Considering the most recent sensor acquisition methodologies that are dominating the industrial world the space community should update the standard in order to include the recent and conceivable evolution of sensors acquisition systems. A natural evolution is pushed by the need to increase the signal integrity and resolution of the transmitted signals, maintaining in any case very low power consumption (or even further decreasing it), and by the availability of miniaturised ASIC-sensors able to locally include the sensor biasing and signal conditioning/processing functionalities. Those capabilities make the need for the definition of standards for digital transmission of sensor data in spacecraft, very pressing, and this is the focus of the present activity. Previous TRP/GSTP activities have already performed an extensive trade-off of existing low speed digital networks, resulting in the proposed adoption, for future space use, of SPI and I2C for simple digital peripheral interconnects.

Based on the intermediate results of two running TEC-EDD activities (Modular RTU – GSTP, Standardization of Digital interfaces – TRP) this activity has prototyped SPI protocol(s) and physical layers for space applications.

A specification taking into account existing solutions has been derived and Signal integrity techniques and also differential variants of the physical layer were investigated and prototyped in order to improve the communication quality and integrity. The SPI model(s) and code(s) for the demonstrator were developed (including HDL IP-core) and the test results will be presented together with the general methodology of the trade-offs performed.